

# Self-Regulation and Problem Solving Ability in 7E-Learning Cycle Based Goal Orientation

Mulyono<sup>1</sup> and N L Noor

Mathematics Department, Universitas Negeri Semarang, Semarang, Indonesia

<sup>1</sup>Corresponding author: mulyono.mat@mail.unnes.ac.id

**Abstract.** Goal orientation differences between mastery goals and performance goals can be a cause of high and low self-regulation and problem-solving abilities. To overcome these problems applied 7E-learning cycle in which students learn and develop ways to optimise the power of reason through the learning phase elicit, engage, explore, explain, elaborate, evaluate, and extend. This study aimed to test the effectiveness of learning by 7E-learning cycle and describe self-regulation and mathematics problem solving based on goal-orientation after the implementation 7E-learning cycle. This study used mix method design with research subject is graders XII sciences MA NU Nurul Ulum Jekulo Kudus which divided into goal orientation is mastery goal and performance goal. The independent variable of this research is learning model, while the dependent variable is problem solving and self-regulation. Then, collecting data using scale, interviews and tests. The data processed with the proportion of test, t-test, paired samples t-test, and Normality-gain. The results show problem-solving abilities of students through 7E-learning cycle the average of mathematical problem-solving capability class, self-regulation at 7E-learning cycle is better than the traditional model study. The problem-solving skills at 7E-learning cycle are better than the traditional model study, there is an increase in self-regulation through 7E-learning cycle of 0.4 (medium), and there is an increased problem-solving ability through 7E-learning cycle by 0.79 (high). Based on the qualitative analysis, self-regulation and problem-solving ability after the implementation of 7E-learning cycle students of a mastery goal group are better than the performance goal team. It is suggested to implement 7E-learning cycle to improve self-regulation and problem-solving ability as well as directing and fostering mastery goal on the student in the learning process.

## 1. Introduction

Mathematics concerning the ideas, structures and relationships governed by mathematical logic so that it is concerned with abstract concepts. The process of the good learning mathematics can make students understand and learn math well too so easy to apply it to next the new situation, namely resolve both in mathematics problems and other science in a daily life.

The problems of mathematics education in Indonesia seen from several indicators, one of is the small achievement of Indonesia in the international ratings. International Survey Program for International Student Assessment (PISA) in 2012 shows that Indonesia in second-bottom ratings of the 65 countries in mathematics [1].

The scope of the subjects of mathematics in senior high school that must be mastered students of grade XI one of them is a differential. In this study takes the material differential. Differential material retrieval is because the material often found difficulty in solving the problem requires an understanding of concepts, reasoning and accuracy. There are variations of the problem and the formula so that students should be good at planning strategies and analysing it. Most are unable to determine the first step that should be used to solve the differentials problem. It shows the low of



problem-solving abilities of students. As a result, the core competencies associated with the differential material can not be achieved to the maximally. Based on data obtained from one of the teachers of mathematics in grade XI MA NU Nurul Ulum Jekulo Kudus, it is known that value of differential material students' daily tests in the academic year 2014/2015 there are still many students who did not complete or did not reach the minimum completeness criteria.

One of the goals of mathematics learning is to develop problem-solving abilities. According to [2], stressed the importance of solving the problem because problem-solving is a part in mathematics, so it should not be released from the learning of mathematics. A problem-solving process in which students find the combination of rules that have been studied before, which can be applied to obtain the solution of a problem or a particular situation [3].

Some of the reasons for the need to teach problem-solving among students according to [4] is (1) Problem solving develops general cognitive skills. Besides, (2) problem-solving fosters creativity and (3) problem solving is a part of the scientific application process, and (4) problem solving motivates pupils to learn mathematics. According to [5] mathematic test that measures aspects of problem-solving can be solved by using the steps (1) understanding the problem, (2) devising a plan, (3) carry out the plan, and (4) looking back.

Steps in the problem solving one of which is to determine a strategy to resolve the problem. The ability to plan learning strategies and targets to be achieved in education is one of the characteristics possessed by students who have self-regulation. Individuals who do self-regulation in learning is an individual who has a knowledge and strategic objectives as well as have the independence to direct their resources effectively in education [6].

**Table 1.** Dimensions of Self-regulation by Zimmerman [7]

Learning Issues	Self-Regulation Sub-Process
Why	<i>Self-efficacy</i> and self-goals
How	Strategy use or routinized performance
When	Time management
What	Self-observation, self-judgment, self-reaction
Where	Environmental structuring
With Whom	Selective help seeking

Zimmerman [7, 8] defines self-regulation as the degree of metacognitively, motivationally, and behaviorally active participants in the learning process to achieve the learning goal. Kauffman [9] has also described self-regulation as the student's effort to control and conduct complex learning activities. The dimensions of self-regulation described in Table 1.

Goal orientation concerning the purpose or goal to be achieved individual in an assignment. The characteristics goal orientation is mastery goal and performance goal [10]. Mastery goal is a motivational orientation of the individual, emphasising acquired new skills or mastery of the material. While the performance goal is a student's orientation to get good results.

Characteristics of goal orientation according to [11, 12] is divided into two: the mastery orientation and performance orientation. Pintrich explains mastery orientation and performance orientation in approach and avoidance states. Detailed descriptions are shown in Table 2.

Based on the problem of a little problem-solving ability of students, it's time to fix the mathematics learning process, especially regarding the strategy and learning model used in the study. 7E-learning cycle developed by Eisencraft is a learning model that provides opportunities for students to optimise learning and students develop reasoning power. The students try to construct their thoughts, so the 7E-learning cycle is a learning model centred on the learner. Steps 7E-learning cycle according to [13]: (1) Elicit, (2) Engage, (3) Explore, (4) Explain, (5) Elaborate, (6) Evaluate, and (7) Extend.

**Table 2.** Characteristics of goal orientation

Goal Orientation	Approach state	Avoidance state
Mastery Orientation	Focus on mastering task, learning, understanding	Focus on avoiding misunderstanding, avoiding not learning or not mastering task

	Use of standards of self-improvement, progress, thorough understanding of task	Use of standards of not being wrong, not doing it incorrectly about task
Performance Orientation	Focus on being superior, besting others, being the smartest, best at task in comparison to others	Focus on avoiding inferiority, not looking stupid or dumb compared to others
	Use of normative standards such as getting best or highest grades, being top or best performer in class	Use of normative standards of not getting the worst grades, being lowest performer in class

Based on the introduction described, the formulation of research problems in this study are (1) is the learning cycle 7E-learning useful? (2) How students' self-regulation and mathematics problem solving after implementation 7E-learning cycle based on goal orientation?

Based on the formulation of the problem, the aims of this study are: testing the effectiveness of learning by 7E-learning cycle, include (1) the ability of students' mathematical problem solving who acquire learning by using 7E-learning cycle can achieve mastery learning. The meaning of mastery learning in this research that if the experimental class of students who scored greater than or equal to 70 reached more than or equal to 75% of the class. Besides, (2) students' mathematical problem-solving ability who acquire learning by using 7E-learning cycle of learning is better than conventional models. Then, (3) students' self-regulation who acquire learning by using 7E-learning cycle of learning is better than traditional models. Also, (4) an increase in students' problem-solving ability before and after the implementation of learning by using 7E-learning cycle. Latter, (5) an increase in students' self-regulation before and after the implementation of learning by using 7E-learning cycle, and describing the self-regulation and solving math problems based on the student's goal orientation after the implementation of the 7E-learning cycle.

## 2. Method

This study design is a mixed method of a sample were students of grade XI MA NU Nurul Ulum Jekulo Kudus grouped based on goal orientation namely the mastery goals and performance goals. The study conducted in five meetings, both in the experimental group: the group obtained using the learning-7E learning cycle and the control group that received learning using conventional learning models. Data collection was performed employing the scale, test and documentation. In the experimental group, students were given a range of goal orientation for grouping into groups mastery goal or a performance goal. At the start of research activities, the pretest tested about problem-solving ability and scale of self-regulation. At the end of the research activities, given problem-solving ability posttest and range of self-regulation. The independent variable of this research is learning model, while the dependent variable is the problem solving and self-regulation. Data processed by the proportion of test, t-test, paired test, and the gain normalised.

## 3. Results and Discussion

Data retrieval goal orientation through a scale for classifying categories of students' goal orientation. Grouping using standard deviation method which limits the group by a particular standard deviation. The results of data processing which is goal orientation scale of 34 students experimental group obtained results in Table 3.

**Table 3.** Results Grouping Students' Goal Orientation.

No	Group	Number of Students
1.	Mastery goal	11
2.	Performance goal	8
3.	Indistinguishable	15

The effectiveness of learning to 7E-learning cycle shown in (1) Based on the results of the problem-solving ability post-test, the proportions test, shows that the students' problem-solving ability experimental group reached the classical completeness, i.e., students who scored more than equal to 70 entering more than equal to 75%. Besides, (2) based problem-solving ability post-test experimental

and control groups, t-test result students' mathematical problem-solving ability who acquire learning by using 7E-learning cycle is better than conventional models of learning. Then, (3) Based on data from the final score of self-regulation scale experimental and control groups, t-test results obtained self-regulation students acquire learning by using 7E-learning cycle is better than conventional models of learning. (4) Based on data from the problem-solving abilities pre-test and post-test experimental group, the pair tested obtained results students' problem-solving abilities after subjected to learning by using 7E-learning cycle is better than problem-solving skills before subjected to learning by using 7E-learning cycle, then the normalised gain test score of 0.79 was obtained with a high category. (5) Based on data from an initial score and the final score of the scale of experimental self-regulation group, the pair tested obtained by students' self-regulation after subjected to learn by using 7E-learning cycle. That is better than self-regulation before subjected to learning by using 7E-learning cycle, then the normalised gain test obtained a score of 0.4 with a medium category.

The results of data processing condition of self-regulation based on the goal orientation of students after the implementation of the 7E-learning cycle consisting of 11 students of mastery goals groups and eight students of target performance group obtained results in Table 4.

**Table 4.** Distribution of Students, Self-Regulation Based Goal Orientation after 7E-Learning Implementation Cycle.

No	Mastery Goal		Performance Goal	
	Frequency	Percentage	Frequency	Percentage
High	4	36.4 %	0	0 %
Medium	7	63.6 %	5	62.5 %
Low	0	0 %	3	37.5 %
Total	11	100 %	8	100 %

Based on Table 4 can be concluded that after the implementation of 7E-Learning Cycle students MA NU Nurul Ulum Jekulo Kudus mastery goal group had high criteria of self-regulation more than the students' performance goal team. Both groups are on the average score of the medium standards of self-regulation, the common measures of the mastery goal group there were seven students (63.6%) it is more than the performance goal unit that is five students (62.5%). At small criteria of performance goal group, there are three students (37.5%) whereas no mastery goal group that has low standards. According [14] there is a difference self-regulated learning between students' mastery goal with students' performance goal.

The goal orientation based groupings have two students of mastery goal groups, and two students of performance goal groups analysed more depth through the method of interviews about self-regulation and problem-solving abilities. Summary results of interviews of self-regulation based on goal orientation group consisting mastery goals and performance goals after the implementation of the 7E-learning cycle in the matrix presented in Table 5.

**Table 5.** Condition Self-Regulation Based on Goal Orientation After Implementation 7E-Learning Cycle

Self-Regulation Indicators	Goal Orientation	
	Mastery Goal	Performance Goal
<i>Self-efficacy</i> and self-goals	Frequently target value during the test, even predicting a problem checked.	At the time of the test do not determine a target value.
Strategy use	Have a particular approach to learning to increase understanding of the material.	Do not have a specific strategy in learning.
Time management	Studious, but still feel the time reserved for work on the test is not enough.	Studious, but still feel the time reserved for work on the trial is not sufficient.
Self-observation, self-judgment, self-reaction	Often taking the time to re-examine the answers to quiz before being collected. Always listen to the discussion of the test questions and feel challenged if it gets an awkward question.	Not taking the time to re-examine the answers to quiz before being collected. Sometimes not listen to the discussion of the test questions and quickly discouraged when gets difficult questions.
Environmental structuring	If the discussion has expressed their opinions, feel comfortable with the learning environment in class.	If the discussion has expressed their opinions, feel uncomfortable with the learning environment in class.
Selective help seeking	If difficulties understanding the material, ask to the cleverer, maximising other educational resources such as books and the internet.	If difficulties understanding the material, ask to the more intelligent, the learning resources only textbook from the teacher. So less to maximise help or educational resources.

Consistent with a study done by [15] shown students who held high mastery goal had a higher ability level than other students holding other types of goals orientation (performance goal or combined mastery goal -performance goal). Based on analysis of interviews students' problem-solving abilities after learning implementation 7E-learning cycle is obtained an increase in the problem-solving ability presented in Table 6.

**Table 6.** Students' Problem Solving Ability Based on Goal Orientation After 7E-Learning Implementation Cycle.

No	Problem Solving Indicators	Goal Orientation	
		Mastery Goal	Performance Goal
1.	Understanding the problem	Students wrote down what is known and asked of problems efficiently.	Students wrote down what is known and asked of the problem, but incomplete
2.	Devising a plan	Students can write a problem-solving plan, is already complete.	Students can write a problem-solving plan, but incomplete.
3.	Carry out the plan	Students can implement problem solutions based plan	Still, there is a mistake in the application of solutions based on the strategy.
4.	Looking back	Students check answers that have been done.	Students did not check back the answers that have been done

#### 4. Conclusion

The conclusions of this study were (1) the learning 7E-learning cycle efficiently (2) self-regulation after implementation 7E-learning cycle group mastery goal has high self-regulation criteria. That is more than the student's performance goals group and the learning problem-solving abilities with 7E-learning cycle students of mastery goal group. It increased can understand the problem to be more precise, planning and problem solving write more systematically, and checks back to the answer by

reading the back problems then examine each of these problems solving steps or to conduct a recount only.

Besides, there are some things to advise. There are (1) 7E-learning cycle used as a reference for teachers to improve students' self-regulation and problem-solving abilities. Then, (2) the increase in students' self-regulation and problem-solving skills can be done by directing and fostering mastery goal on the students in the learning process, and (3) Need for further research as the development of different grade level or material.

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